

Discover the National Marine Sanctuaries

A Research Prospectus



**National Oceanic and Atmospheric Administration
National Ocean Service
National Marine Sanctuary Program**

OUR SEAS AND OUR SKIES



February 2000





February 11, 2000

Dear Researchers:

Thank you for your interest in our nation's National Marine Sanctuaries. We want to take this opportunity to familiarize you with the National Marine Sanctuary Program and the research and monitoring activities occurring in the sanctuaries.

At present, there are 12 National Marine Sanctuaries located within U.S. continental and territorial waters. The National Oceanic and Atmospheric Administration's (NOAA's) National Marine Sanctuary Program is responsible for the conservation and management of these marine reserves and is charged with supporting, promoting, and coordinating long-term monitoring and research within them. Each National Marine Sanctuary is unique in its setting and resources; research and monitoring activities vary accordingly. Most sanctuaries develop annual research plans that address site-specific and national research priorities. Some do so in cooperation with informal or formal advisory groups.

Some funding for research programs comes from site budgets, but the majority are funded by outside support from other governmental agencies and the private sector. Generally speaking, very little research is funded directly from sanctuary budgets. However, considerable effort is focused on facilitating research in the sanctuaries through offers of logistical support, including the complimentary use of sanctuary vessels and field stations, and arrangements for time aboard NOAA ships. The National Marine Sanctuary Program staff also work with other agencies and institutions to provide incentives for investigators proposing work in sanctuaries.

Recent indications are that increases in federal appropriations for the National Marine Sanctuary Program may allow more direct funding for sanctuary research and monitoring through contracts, grants, fellowships, and other partnerships with agencies and academic institutions. Our FY1999 appropriation of approximately \$14 million was increased to \$26 million in FY2000. The President's Budget Request for FY2001 requests an additional increase.

This package contains a map of the sanctuary locations; the Science Plan for the National Marine Sanctuary System; information on current research efforts and needs at the sanctuaries; and sources for additional information. It is our hope that those of you who are interested in the National Marine Sanctuary Program will review this information and begin to think about, and discuss with us, the potential links between your research and the sanctuaries. Thank you for your consideration.

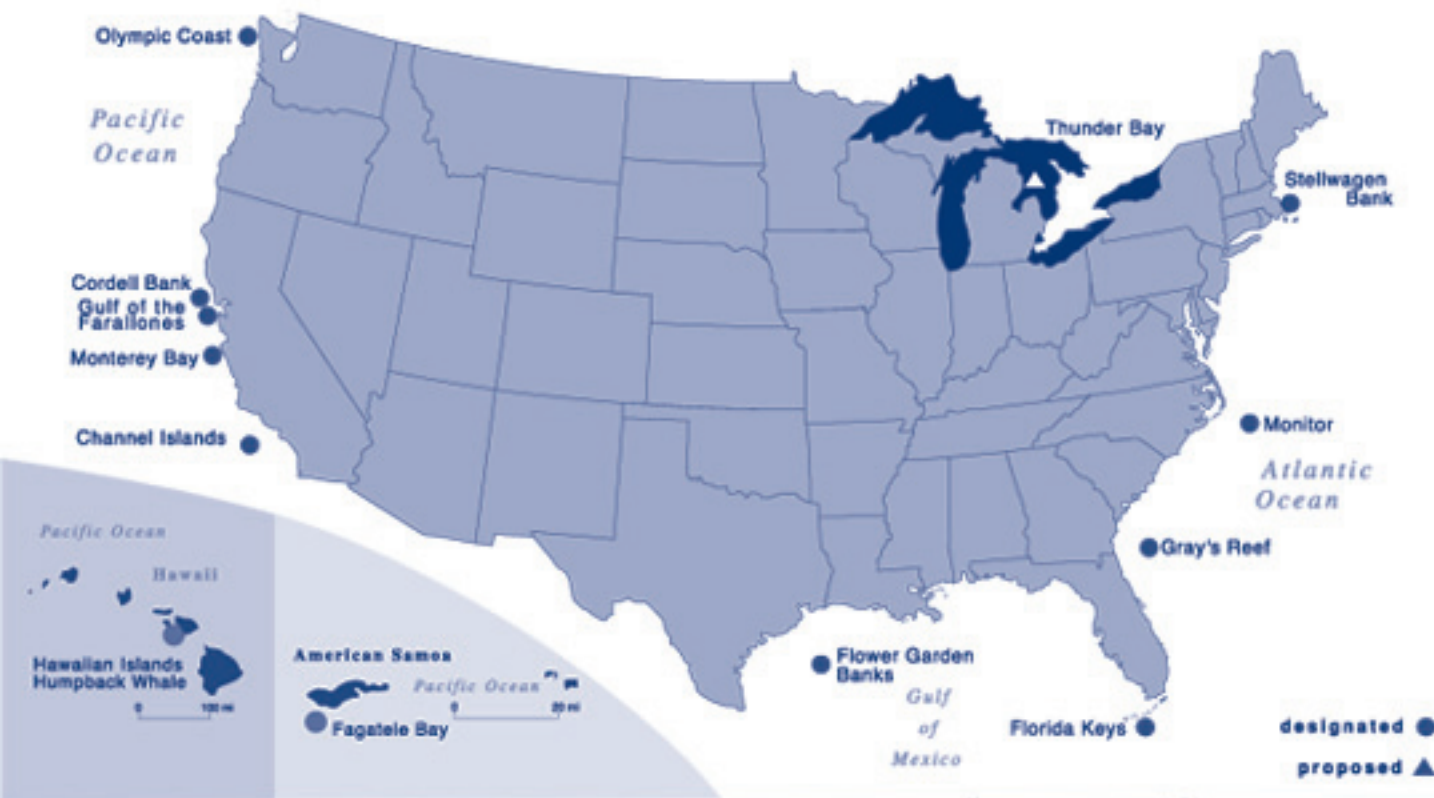
Sincerely,

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Enclosures

NOAA's National Marine Sanctuaries





Science Plan For the National Marine Sanctuary System

The National Marine Sanctuaries Act (NMSA) of 1972, as amended, authorizes the Under Secretary for Oceans and Atmosphere to designate discrete areas of the marine environment as National Marine Sanctuaries (NMSs). To date, twelve NMSs compose the National Marine Sanctuary Program (NMSP). This program is administered by the National Oceanic and Atmospheric Administration's (NOAA's) Office of Ocean and Coastal Resource Management (OCRM), Marine Sanctuaries Division (MSD). Its mission is to identify, designate, protect and manage the ecological, recreational, research, educational, historical, and aesthetic resources and qualities of nationally significant coastal and marine areas.

The NMSs differ widely in their natural and historical resources. They include nearshore and open ocean waters and range in size from less than 1 to over 5,000 square miles. Protected habitats include rocky coasts, kelp forests, coral reefs, sea grass beds, estuarine habitats, hard and soft bottom habitats, segments of whale migration routes, and shipwrecks. Because of their diversity, each site has a tailored management plan. Education, research, monitoring and enforcement programs vary accordingly.

Fundamental to the success of the sites and the mission of the MSD is the development and consistent application of a rigorous, objective scientific foundation for evaluating ecosystem health and implementing effective and sustainable management strategies. The Science Plan provides the framework for establishing this scientific foundation and will enable the NMSP to accomplish priority tasks outlined in its strategic plan, some directly, such as habitat characterization and resource monitoring, and others indirectly. The Plan is rooted in conservation science, a field that offers a mission-oriented, multi-disciplinary approach to the assessment, protection, monitoring, maintenance, and restoration of cultural and natural resources. The Plan is also intended to contribute to the annual planning process for the sites and the national program and to ensure that all NMSs have the staff or capability to assure effective coordination of site-specific and issue-directed planning and research.

GOALS

Infrastructure

Strengthen the quality and focus of marine research by ensuring that the national system of sanctuaries has adequate, qualified research staff, effective research and information management programs, and productive inter- and intra-agency partnerships.

Resource Assessment

Profile the structural and functional elements of Sanctuary ecosystems. This will include delineation of biological community dynamics, identifying links with abiotic processes, and evaluating the social, cultural and economic aspects of marine sanctuaries, and effects of human activities on natural systems.

Resource Monitoring and Research

Improve resource management decisions and strategies by implementing a quality research and monitoring program to document trends and produce information or data to guide day-to-day operations. The objective is to create a strong conservation science and monitoring program to support management of marine protected areas.

APPROACH

Principal functions of the NMSP are resource management, conservation policy development, resource protection, public education and outreach, and conservation science. Each contributes to and is guided by the others. Monitoring, site assessment, and research address the conservation science needs of the NMSP (see attached figure). These elements provide scientific information to: understand ecosystem function and change; ensure objective decision-making in responding to emerging management issues; allow for effective intervention, when appropriate, to mitigate damage and enhance the ability of natural communities to recover from human-caused injury; and form the basis of national policy. Effectiveness of these elements can only be assured by the development of strategic linkages with appropriate partnering organizations and plans. A variety of communication mechanisms will enhance the contributions of conservation science to other functions of the NMSP, and vice versa.

INFRASTRUCTURE

Staffing

Permanent scientific staff at each site is essential to carry out and direct research and monitoring to meet management objectives. Research Coordinators at field sites, supported by effective communication and research plans, and productive partnerships will be able to guide scientific activities to address management needs. Each site will also need appropriate staff, equipment, vessel support, and information management systems and evaluation capabilities to have an effective science program. Research Coordinator meetings, as well as scoping

meetings and workshops, will be held to identify and prioritize research and monitoring needs in the context of important management issues. Priorities will be integrated into the annual budget planning process and long-range strategic planning by the MSD.

Data and Information Management

A well designed information management and dissemination system will facilitate conservation science based management. Clear quality assurance/quality control criteria for data quality and management will be established and enforced. Information management systems will be designed to be widely accessible and applicable. An MSD report series will be initiated to disseminate project results, and researchers will be encouraged to publish relevant scientific material in this or peer-reviewed scientific publications.

Strategic Linkages

Partnerships will be used to expand federal, state, and local support for the NMSP, increase resource leveraging, and improve national ocean governance structure. The NMSP anticipates working directly with numerous partners to implement the Science Plan throughout the sites. NOAA's National Centers for Coastal Ocean Science will provide valuable advice and assistance in the implementation of this plan. NOAA's Coastal Services Center will play an integral role in developing data management strategies and geographic information system (GIS) capabilities. We will look to the National Undersea Research Program for support for research, vessels, facilities, and technical expertise. Other potential federal partners in implementation, data sharing and data management include: the National Marine Fisheries Service, Sea Grant, U.S. Navy, the National Fish and Wildlife Foundation, the Environmental Protection Agency, the National Aeronautics and Space Administration, the National Park Service, the U.S. Geological Survey, and the U.S. Fish and Wildlife Service. We plan to work with our state and territorial partners involved in managing the National Estuarine Research Reserves System, the National Estuarine Programs, state resource management agencies, and the Coastal Zone Management Programs. Potential non-governmental organization partners include the National Geographic Society, the Center for Marine Conservation, Reef Environmental Education Foundation, local Sanctuary associations, colleges and universities, private research institutions, and others.

RESOURCE ASSESSMENT

Site assessment and characterization data will allow managers to better understand the protected natural and cultural resources and important environmental processes and threats in the NMSs. This will enable effective policy development, risk management, and threat reduction as well as enhance education and outreach programs of the NMSs. Comprehensive site characterizations for the sanctuaries are a strategic planning priority for the MSD. Such characterizations will provide an inventory and descriptions of biodiversity, habitats, resources, ecological processes. They will also explore socioeconomic, scenic and existence values along

with public perception of the benefits and costs of sanctuary management. Both synthesis and acquisition of baseline data are required for site characterization. Synthesis of existing information is an important first step that will identify data gaps and information needs. This information will be used as a foundation upon which to develop future research and monitoring plans. Characterization guidelines will also be developed to guide future site characterization efforts. Synthesized and acquired site characterization data will be managed in electronic and hard copy resource libraries.

RESOURCE MONITORING AND RESEARCH

Monitoring

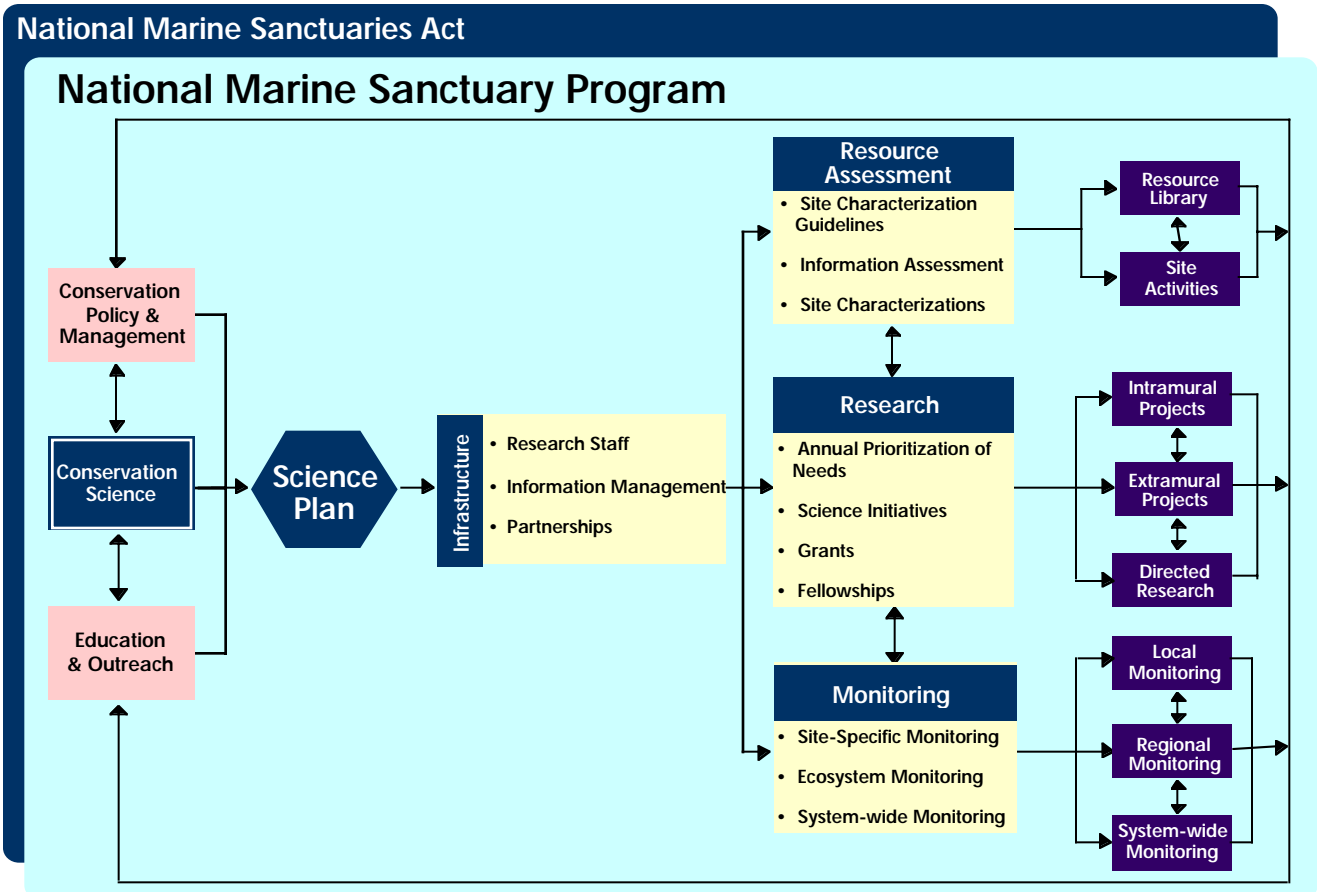
Monitoring data will be acquired and compiled, allowing managers to establish baseline conditions and discern trends so they may effectively conserve, enhance, and restore habitats and ecosystems. Ecosystem or regional monitoring program (e.g. a Coral Reef Monitoring Program), and a System-Wide Monitoring Program will enhance site-specific efforts to track structural, functional, biological, chemical and physical parameters indicative of resource conditions and trends in the NMSs. Monitoring plans will be developed by experts within MSD and NOAA, and with input from outside partners. They will be implemented on a system-wide, regional, and/or local basis by utilizing a combination of standardized and site specific equipment and protocols. Multi-site, ecosystem-specific monitoring programs (e.g. coral reefs, kelp forests, rocky shores, sea bird rookeries) will be developed to track conditions and trends within certain important resource types. Conditions and trends of national dimensions of the NMSP (e.g. water quality) will be assessed through system-wide monitoring. When appropriate, information, data and protocols for data collection and management from other sources (e.g. NERRS, non-NOAA monitoring programs) will be integrated.

Research

Research results will demonstrate linkages between nature and human activities, and contribute to effective resource management by facilitating information-based decision-making. Research efforts should focus on important management issues such as the effectiveness of marine zoning, fisheries impacts, user profiles, land-based ecological impacts, and risk assessment, or nationally significant themes such as marine biodiversity, essential habitat identification and conservation, and global climate change. Local, regional and system-wide research needs will be prioritized annually. Research will be conducted by MSD field staff, other NOAA offices, research fellows, and outside agencies, associates and institutions. Three research project/funding scenarios are anticipated: 1) *intramural* research projects, funded by MSD and conducted by the staff at NMSs; 2) *extramural* research projects, funded by grants and conducted by outside agencies and institutions; and 3) *directed* research projects within NMSs, funded and conducted by outside agencies and institutions with guidance from the MSD. A graduate research fellowship program will facilitate extramural research projects. As the awareness and profile of the NMSP is raised through major research initiatives, it is expected that directed research will increase.

FUNCTIONAL INTEGRATION

The attached figure depicts the elements of the Science Plan and their relationship to each other as well as the context of conservation science within the NMSP. The Science Plan is designed to provide information required for the development of informed conservation policy and resource management decisions, but also actively contributes to MSD education and outreach efforts. The MSD will integrate natural sciences with socioeconomic and cultural sciences to provide the foundation upon which successful protection, maintenance, and restoration of species and ecosystems can be accomplished. Feedback from these functional elements of the NMSP, in turn, bears on annual and longer-term science priorities and efforts. In combination, the MSD can address the diverse needs of its resource protection mandate.





Research Efforts and Needs in the National Marine Sanctuaries

Research and monitoring are essential components of the overall management strategy for national marine sanctuaries. Data are important for making informed management decisions; implementing effective and sustainable management strategies; and assessing the efficacy of management actions. Scientific research helps us understand the natural resources and the functioning of the protected ecosystem. The information gathered from research and monitoring is also used to educate the public so they too can better understand and protect these unique marine areas.

Current research activities and needs for each of our nation's 12 National Marine Sanctuaries are listed below. Research and monitoring projects in the national marine sanctuaries are carried out and supported by numerous partners, including Federal, state, and local agencies, academic institutions, and non-governmental organizations. When possible, partners have been noted in parentheses following project names.

CHANNEL ISLANDS, Southern California

Current Research Efforts:

- Searching for giant sea bass (Kathy deWet-Oleson)
- Effect of 1998 El Niño on breeding biology of the ashy storm petrel (Harry Carter *et al.*/U.S. Geological Survey and Humboldt State University)
- Population monitoring of Brandt's and Double-crested cormorant colonies (Harry Carter *et al.*/U.S. Geological Survey and Humboldt State University)
- Egg and larval fish production from Marine Ecological Reserves (Russ Vetter *et al.*/National Marine Fisheries Service, SWFSC)
- Pinniped population studies on San Miguel Island (Robert DeLong/National Marine Fisheries Service, NMML)
- Southern California Bight 1998 Regional Marine Monitoring Study (Sarah Fangman *et al.*/Channel Islands National Marine Sanctuary)
- Plumes and blooms - studying the color of the Santa Barbara Channel (David Siegel *et al.*/University of California-Santa Barbara, ICES)

- Kelp forest monitoring (David Kushner *et al.*/Channel Islands National Park)
- Photo-identification of humpback and blue whales (John Calambokidis *et al.*/Cascadia Research Collective)
- Aerial monitoring of pinnipeds (Doyle Hannan *et al.*/California Department of Fish and Game)
- Aerial monitoring of sea otters in otter management zone (Carl Benz *et al.*/U.S. Fish and Wildlife Service)
- Brown pelican distribution, abundance, and habitat use at coastal roosts (Frank Gress *et al.*)
- Island intertidal monitoring (Dan Richards *et al.*/Channel Islands National Park)
- At-sea seabird aerial surveys (Harry Carter *et al.*/U.S. Geological Survey and Humboldt State University)
- Channel Islands National Marine Sanctuary vessel and marine mammal aerial surveys (Matt Pickett *et al.*/Channel Islands National Marine Sanctuary)
- Channel Islands National Marine Sanctuary aerial kelp mapping (Matt Pickett *et al.*/Channel Islands National Marine Sanctuary)
- Sidescan sonar investigations (Guy Cochrane/U.S. Geological Survey)

Research Needs:

- Benthic habitats characterization
- Characterize flora and fauna of the Channel Islands
- Kelp canopy monitoring
- Investigate squid spawning habitat
- Ecosystem monitoring - develop comprehensive and integrated monitoring program

CORDELL BANK, North Central California

Current Research Efforts:

- Distribution and abundance of euphausiids
- Biotoxin monitoring
- Seabird monitoring
- Cetacean surveys
- Juvenile rockfish surveys

Research Needs:

- Characterize Cordell Bank and its associated flora and fauna
- Ecosystem monitoring - resume long term monitoring program
- Investigate fishing effects

- Investigate the relationship and timing between the seasonal development of krill biomass and the appearance and feeding behavior of blue whales
- Dedicated seabird and marine mammal surveys

FAGATELE BAY, American Samoa

Current Research Efforts:

- Coral reef monitoring (Fagatele Bay National Marine Sanctuary, American Samoa Environmental Protection Agency)
- Coral survey (Dr. Craig Mundy/University of Tasmania; Dr. Alison Green/Great Barrier Reef Marine Park Authority)
- Biological survey (Dr. Charles Birkeland/University of Guam and Fagatele Bay National Marine Sanctuary)

Research Needs:

- Fish: recruitment study; fish age structure study in key (fished) species; shark population study (ranges, species composition, age structure and recruitment)
- Coral: recruitment studies, genetic analysis, predation impacts, spawning and larval recruitment success, species distributions in Fagatele Bay
- Turtles: nesting and hatch success; population census in Fagatele Bay
- Invertebrate: survey and inventory of echinoderms, which may be key indicators of environmental condition - assessment of status in presumably unaltered environments; identification of factors that affect recruitment of octopus, lobster, and corals, including limits to spawning, reproductive behavior, larval supply, habitat limitation, post-settlement processes, and sources of recruits
- Water circulation
- Comparing coral health in shallow and deep water and investigating deepwater benthic communities
- Long-term study on coral bleaching assessments as linked to climate change (temperature and UV increases)
- Potential changes in other physical parameters (nutrients, heavy metals)
- Groundwater movement and transport of nutrients and contaminants from the landfill
- Economic valuation of Sanctuary and alternatives to development for landowners in the watershed
- Survey of cultural history in Fagatele Bay, survey of village sites, artifacts
- GIS mapping of significant coral heads, other features, cultural resources
- Humpback whale identification and song recordings (Sally Mizroch/National Marine Fisheries Service)

FLORIDA KEYS, Florida

Current Research Efforts:

- Comparative analysis of the ecological structure and functioning of disturbed versus undisturbed coral reef areas
- Water movement affecting coral reef organisms
- Factors causing/accelerating erosion
- Reproductive biology of corals
- Coral growth rates
- Coral recruitment success
- Genetic analysis of corals
- Sea fan reproduction
- Foraminiferan bleaching
- U/V effects on bleaching
- Bleaching physiology
- Disease microbiology, etiology, and restoration
- Sponge growth
- Chemical defenses of invertebrates
- Herbivory and reef structure
- Microbial assays and U/V induced microbial damage to corals
- Production and release of nutrients from reefs
- Groundwater movement
- SEAKEYS data collection
- Upper Keys water circulation
- Delivery of nutrients, plankton, and larvae to the reefs
- Impact of internal borers on coral reefs
- Contaminant impacts on coral reefs
- Water column carbon dynamics
- Effect of Florida Bay water on the reefs
- Lobster ecology and reproduction
- Reef fish censusing
- Sexual behavior in reef fish
- Fish diseases
- Ecology of Halimeda
- Historical output from Florida Bay
- Historical environmental records through coring large coral heads

Research Needs:

- Analysis and synthesis of monitoring data
- Establish research and monitoring programs in the proposed Tortugas marine reserve to enhance baseline characterizations and distinguish natural system variability from change caused by proposed management strategies
- Mapping of deep water habitats
- Reef community stability, coral growth
- Identification of factors that affect recruitment of conch, lobster, and corals including, limits to spawning, reproductive behavior, larval supply, habitat limitation, post-settlement processes, and sources of recruits
- Bioerosion and the balance between bioerosion and reef growth under various conditions
- Atmospheric CO₂ and its relationship to reef growth
- Artificial reef assessments (reef fish community successional processes, community development, patterns of human use)
- Comparing coral health in shallow and deep water and investigating deepwater benthic communities
- Restoration research (ecological controls, enhancement strategies)
- Develop carrying capacity thresholds for the coral reef

FLOWER GARDENS, offshore Texas/Louisiana

Current Research Efforts:

- Sea bird observations (Jeff Childs/Texas A&M University)
- Fish genetics (Derek Hagman and Peter Vize/University of Texas)
- Coral spawning/reproduction (Derek Hagman and Peter Vize/University of Texas)
- Sea turtles - occurrence and satellite tracking (Emma Hickerson/Texas A&M University)
- Endosymbiotic algae within coral tissues (Jay Reichman/University of Texas)
- Crustaceans of Stetson Bank (Mary Wicksten/Texas A&M University)
- Occurrence of elasmobranchs (Jeff Childs/Texas A&M University)
- Manta census and individual identification (Jeff Childs/Texas A&M University)
- Fish cleaning behavior (Mary Wicksten/Texas A&M University)
- Stetson Bank Long-Term Monitoring (Flower Garden Banks National Marine Sanctuary)
- Flower Garden Banks Long-Term Monitoring (under contract to Center for Coastal Studies/Texas A&M University)

- Population age structure in damselfish (Chris Caldow and Jerry Wellington/University of Houston)
- Genetics and morphology of macroalgae and decapod crustaceans (Darryl Felder/University of Southwestern Louisiana)
- Stable nitrogen isotope signatures as indicators of riverine inputs of inorganic N in the offshore systems of the Gulf of Mexico (Ken Dunton and Lanny Miller/UTMSI)
- Assessing macro-algal biodiversity and biogeographic patterns in the northwestern Gulf of Mexico hard bank communities (Suzanne Fredericq, Naomi Phillips, and Brigitte Gavio/University of Southwestern Louisiana)
- Reef conductivity: A study of larval supply and source of recruits to the Florida Keys and the Flower Garden Banks (Mary Alice Coffroth/Tonya Snell/SUNY-Buffalo)
- Coral paleoclimatology (Niall Slowey/Texas A&M University)
- Population dynamics of reef fishes (Christy Pattengill/Texas A&M University)
- Coral restoration - future (Flower Garden Banks National Marine Sanctuary; Florida Keys National Marine Sanctuary)
- Manta ray genetics (Tim Clarke/Texas A&M University)
- Sponges (George Schmahl/Flower Garden Banks National Marine Sanctuary)

Research Needs:

- Long-term monitoring program - maintain Minerals Management Service/NOAA partnership to conduct shallow reef monitoring
- Deep reef/deep habitat assessment (faunal structure and biodiversity)
- Deep water fish assemblage characterization
- Brine seep re-assessment (flow rates, microbial assemblage condition)
- Geological characterizations, particularly ground-truthing existing images, and assessing the effects of salt dissolution and removal, graben development, and topics related to reef development, such as reef cap thickness and relict spur-and-groove formations
- Survey and inventory of echinoderms - which may be key indicators of environmental condition - assessment of status in presumably unaltered environments
- Censuses and surveys of elasmobranchs to evaluate seasonal use, habitat fidelity, life history, species interactions, and population dynamics
- Sea turtle tracking, genetics, and population studies
- Coral genetics/taxonomy
- Sources of recruitment and processes affecting it

- Comprehensive water quality evaluation, including seasonal and longer term dynamics and associations with regional processes (river discharges, nutrient enrichment, upwelling, loop current eddies)
- Damselfish ecology
- Diving-based deep reef assessment (faunal structure and biodiversity)
- Collection of monitoring data related to water quality, benthic community condition, and fish assemblages
- Exotic species and the factors affecting their success (e.g. island-hopping on oil and gas structures, mooring buoy use by larvae, species interactions, local reproduction, genetic diversity)

GRAY'S REEF, Georgia

Current Research Efforts:

- Geoarchaeology (Erv Garrison/University of Georgia)
- Groundwater (Willard Moore/University of South Carolina)
- Benthic invertebrates
 - ROV benthic and fish surveys (Lance Horn/National Underwater Research Center/University North Carolina-Wilmington; Doug Weaver/U.S. Geological Survey)
 - Invertebrate Characterization - McFall/University North Carolina-Wilmington; Alex Score/Gray's Reef National Marine Sanctuary)
- Fisheries
 - Long-term fish monitoring via diver stationary visual protocols (Dave Score/Gray's Reef National Marine Sanctuary; Tom Potts/National Underwater Research Center/University North Carolina-Wilmington; Roger Mays/NOAA-National Ocean Service)
 - Marine Resources Monitoring, Assessment, and Prediction Program (MARMAP) (George Sedberry/South Carolina Department of Natural Resources)
 - Larval fish recruitment (anticipated summer 2000) (Jon Hare/NOAA-National Ocean Service)
- Marine microbe isolation (LaRoche/Phytera)
- Sea Turtle Satellite Tagging Project (Alex Score/Gray's Reef National Marine Sanctuary)
- North Atlantic right whale migration (Chris Slay/New England Aquarium)

Research Needs:

- Deep water reef baseline assessment (benthic invertebrate species composition and community development), including communities on shelf-edge features recently discovered seaward of Gray's Reef National Marine Sanctuary

- Mid and deep water reef fish population baseline assessment
- Sea turtle satellite and sonar tracking to assess home ranges, site fidelity, habitat requirements, migration patterns, and life histories of sea turtles
- Geoarchaeological surveys (sub-bottom profiling, ground truthing) to assess historic patterns of use
- Vibracoring to collect sediment cores for studies of paleoconditions
- Collection of monitoring data related to water quality, benthic community condition, and fish assemblages

GULF OF THE FARALLONES, North Central California

Current Research Efforts:

- Distribution and abundance of euphausiids
- Biotxin monitoring
- Seabird monitoring
- Cetacean surveys
- Juvenile rockfish surveys
- Rocky intertidal monitoring
- Shoreline surveys (human use/impacts, birds, mammals, and strandings/mortality events)
- SEALS
- Baseline habitat characterization of Bolinas Lagoon, Tomales Bay, and both Esteros (w/ California Department of Fish and Game)
- Mortality, mark-recapture, tissue analyses of abalone (w/ California Department of Fish and Game)
- Evaluation of the radioactive waste dumpsite (w/ Environmental Protection Agency and U.S. Geological Survey)
- Restoration of the common murre (w/ U.S. Fish and Wildlife Service and California Department of Fish and Game)
- Assessment of the ashy-storm petrel population parasitic infestation rates of emeita and sandy beach habitat
- Monitoring/*Puerto Rican* restoration project

Research Needs:

- Seabird issues
- Damage assessment from oil spills
- Characterizing fish and invertebrate assemblages associated with hard and soft substrates in the Gulf of the Farallones
- Ecosystem monitoring - maintain long-term monitoring program in Gulf of the Farallones National Marine Sanctuary
- Locate and investigate the integrity of the oil tanker *Puerto Rican*, which was full of oil when it sank in the Gulf of the Farallones. This vessel has

been implicated in connection with winter tarball incidents in the Gulf of the Farallones.

- Investigate the relationship and timing between the seasonal development of krill biomass and the appearance and feeding behavior of blue whales
- Survey the shelf and slope to document the extent and area affected by the Farallon Radioactive Waste Dump
- Assess risks associated with a radioactive waste dump site and deep marine disposal site located within the sanctuary

HAWAIIAN ISLANDS, Hawai'i

Current Research Efforts:

- Examination of night-time behavior of humpback whales in Hawaiian waters (Robin W. Baird)
- Examination of the behavior and development of humpback whale calves (Rachel Cartwright)
- Investigation of the social function of humpback whale song (Jim Darling)
- Vital parameters, study of the life history of humpback whales (Mark and Debbie Ferrari)
- Investigations of humpback whale demographics, behavior, and growth in the Hawaiian Islands (Louis Herman and Adam Pack)
- Satellite monitored radio tracking of humpback whale movements within the Hawaiian Islands (Bruce R. Mate)
- Aerial survey and aerial photogrammetry of humpback whales wintering in Hawaiian waters (Joseph R. Mobley, Jr.)
- Culture research on historical significance of whales in Hawaii

Research Needs:

- Baseline studies to determine features and processes of the North Pacific humpback whale wintering habitat. This should include: vital rates, behavior, abundance, and distribution of humpback whales; interactions among the living resources within the Sanctuary; and types and patterns of human activities within and around the Sanctuary.
- Monitoring studies to document changes in humpback whale behavior, Sanctuary use patterns, environmental quality, and human activities and their effects on Sanctuary resources.
- Predictive studies to assess causes and effects of ecological and environmental changes.
- Cataloging past, present, and future research data information.
- Studies of marine resources, other than humpback whales, for possible inclusion in the Sanctuary.

MONITOR, North Carolina

Current Research Efforts:

- Pre-stabilization/Engine Recovery Expedition, May 2000
Diving operations will be conducted prior to the stabilization and engine recovery expeditions to recover artifacts that may be lost or destroyed during the actual recovery operations and to clear the engineering areas of the wreck of as much bottom sediments as possible to facilitate less prep work during the actual stabilization/recovery operations.
- Stabilization and Engine Recovery Expedition, June-July 2000
With assistance from the United States Navy, an expedition will stabilize critical areas of the *Monitor's* hull using specially designed cement bags. Once stabilization is complete, removal, and recovery of the *Monitor's* unique vibrating lever steam engine will begin.

Research Needs:

- Survey work is needed, particularly high-resolution surveys using laser line-scanning techniques and high-resolution sonar.
- Manned or unmanned diving support to continue survey of the *Monitor's* hull and contents.
- Engineering support to continue implementation of the comprehensive long-range preservation plan for the *Monitor* dated April 1998.

MONTEREY BAY, Central California

Current Research Efforts:

- A beach monitoring program to assess natural and anthropogenic changes in populations of birds, mammals, and turtles in the Monterey Bay National Marine Sanctuary (Scott R. Benson/Moss Landing Marine Laboratories; Andrew P. De Vogelaere/Monterey Bay National Marine Sanctuary; and James T. Harvey/Moss Landing Marine Laboratories)
- Rocky shore monitoring projects in the Monterey Bay National Marine Sanctuary: recovery after ship groundings and assessing natural variability (Andrew De Vogelaere and Michele Jacobi/Monterey Bay National Marine Sanctuary; Ronald Walder and Michael Foster/Moss Landing Marine Laboratories)
- Assessing marine bird and mammal bycatch in a California gillnet fishery (Karin A. Forney/National Marine Fisheries Service; Scott Benson/Moss Landing Marine Laboratories; and Andrew De Vogelaere/Monterey Bay National Marine Sanctuary)
- A field study of the effects of CO₂ ocean disposal on mobile deep sea animals (Mario N. Tamburri/Monterey Bay National Marine Sanctuary and Monterey Bay Aquarium Research Institute; Edward T. Peltzer, Gernot E. Friederich, and Peter G. Brewer/ Monterey Bay Aquarium Research Institute; Izuo Aya and Kenji Yamane/Ship Research Institute)

- Abundance and impacts of the exotic green crab in Elkhorn Slough (Edwin Grosholz/University of California at Davis; Andrew De Vogelaere/Monterey Bay National Marine Sanctuary)
- Effects of human trampling and cattle grazing on salt marsh assemblages in Elkhorn Slough, California (Andrea Woolfolk/Moss Landing Marine Laboratories)
- Kelp canopy monitoring in central California: temporal changes and effects from harvesting (Mario Tamburri/Monterey Bay National Marine Sanctuary and Monterey Bay Aquarium Research Institute; Mike Donnellan/Moss Landing Marine Laboratories; Andrew De Vogelaere and Aaron King/Monterey Bay National Marine Sanctuary; Matt Edwards/University of California at Santa Cruz)
- Mortality of sea lions along the central California coast linked to a toxic diatom bloom (Chris Scholin/Monterey Bay Aquarium Research Institute; Frances Gulland/Marine Mammal Center; Gregory Doucette/Marine Biotoxins Program, NOAA; Andrew De Vogelaere/Monterey Bay National Marine Sanctuary)
- Seafloor mapping and habitat characterization in the Monterey Bay National Marine Sanctuary (Steve Eittreim/U.S. Geological Survey; Mary Yoklavich/National Marine Fisheries Service; H. Gary Greene/Moss Landing Marine Laboratories; Richard Starr/University of California Sea Grant)
- Temporal variability in the cetacean assemblage of a coastal upwelling system spanning an El Niño event (Scott R. Benson/Moss Landing Marine Laboratories; Donald A. Croll and Baldo Marinovic/University of California at Santa Cruz; James T. Harvey/Moss Landing Marine Laboratories)

Research Needs:

- Thorough evaluation and collation of existing regional monitoring information.
- Mapping essential fish habitats and ocean currents near marine protected areas
- Ship time for ecosystem monitoring component for protected whales, sea birds, and krill
- Sediment budget for Big Sur coastline to assist in making decisions on dumping after annual highway maintenance
- Characterization of flow and impacts of dredge spoils moved from Moss Landing to the edge on Monterey Canyon (ecological risk assessment)
- Comprehensive assessment of cultural resources
- Evaluation of the utility of remote sensing using LIDAR or GeoSAR for intertidal and coastal work (out to 30-100 m)
- Kelp canopy monitoring program

- Regional assessment of human impacts to rocky shores
- Study of the role of high coastal nitrate levels in development of harmful algal blooms
- Assessment of the current status and potential introductions of alien species
- Determination of the cause of recent sea otter population declines

OLYMPIC COAST, Washington

Current Research Efforts:

- At-sea seabird distribution and abundance (Chris Thompson and Ken Warheit/Washington Department of Fish and Wildlife)
- Seabird colony monitoring (Julia Parrish/University of Washington; Ulrich Wilson/U.S. Fish and Wildlife Service)
- Beached bird surveys (Julia Parrish and Todd Haas/University of Washington; Mary Sue Brancato/Olympic Coast National Marine Sanctuary)
- Sea otter monitoring (Ron Jameson/U.S. Geological Survey; Steve Jeffries/ Washington Department of Fish and Wildlife; Ed Bowlby/Olympic Coast National Marine Sanctuary)
- Subtidal surveys (Mike Kenner/University of California-Santa Cruz; Rikk Kvitek/California State University-Monterey Bay; Ed Bowlby/Olympic Coast National Marine Sanctuary)
- Kelp surveys (Bob VanWagenen/Ecoscan; Tom Mumford/Washington Department of Natural Resources; Ed Bowlby/Olympic Coast National Marine Sanctuary)
- Biotoxin investigations (Vera Trainer/National Marine Fisheries Service; Rita Horner/University of Washington; Mitch Lesoing/Quileute Natural Resources)
- Intertidal monitoring (Carl Schoch/Oregon State University; John Meyer/Olympic National Park)
- Pinniped surveys (Steve Jeffries/Washington Department of Fish and Wildlife; Harriet Huber and Pat Gearin/National Marine Fisheries Service)
- Cetacean surveys (Pat Gearin/National Marine Fisheries Service; John Calambokidis/Cascadia Research Collective; Barry Troutman/Washington Department of Fish and Wildlife)
- Marine mammal strandings (Mary Sue Brancato/Olympic Coast National Marine Sanctuary; Brent Norberg/National Marine Fisheries Service)
- Exotic species and water quality (Mary Sue Brancato/Olympic Coast National Marine Sanctuary)
- Fish surveys (Tom Jagielo and Ray Buckley/Washington Department of Fish and Wildlife)

- Cultural resource surveys (Bruce Terrell/NOAA; Mark Norder/Coastal Marine Archaeology Resources)
- Marine geology (Pat McCrory/U.S. Geological Survey)
- Seafloor habitat surveys (LCDR Rick Fletcher/NOAA; Rikk Kvitek/California State University-Monterey Bay)

Research Needs:

- Seafloor habitat characterization, including cross-shelf characterization
- Comparison of benthic communities in heavily and lightly trawled habitats
- Marine mammal and seabird at-sea distribution
- Kelp canopy monitoring
- Harmful algal bloom survey
- Groundfish behavior studies related to survey trawls
- Submarine canyon surveys to evaluate their influence on surface productivity and benthic assemblages
- Cold seep habitats and communities
- Geological hazard and nearshore sediment mapping
- Whale photo-identification surveys
- Drift algal habitat survey

STELLWAGEN BANK, Massachusetts

Current Research Efforts:

- Develop baseline maps of seafloor habitats using multibeam sonar
- The role of variation in landscape features on the distribution and abundance of fishes
- Assessing the representativeness of Stellwagen Bank National Marine Sanctuary to the Gulf of Maine region based on the diversity of fishes
- Verification of density dependent distribution models using trawl samples of fishes (completed)
- Developing protocols for monitoring invertebrate biodiversity using ROV/camera sled (ramping up this activity)
- Recovery rates of emergent fauna from fishing gear impacts
- Modelling the role of protected areas for conservation of fishes
- Habitat and stage dependent movement rates of fishes (beginning pilot study)
- Ambient noise effects on marine mammals
- Water quality monitoring (Massachusetts Water Research Authority and Sea Education Association)

- Marine mammal abundance, distribution, migration (Cetacean Research Unit)
- Seabird distribution and abundance (Center for Coastal Studies -ramping up)
- Right whale habitat use/migration (Center for Coastal Studies and New England Aquarium)
- Sanctuary use studies (U.S. Coast Guard overflights, USCGA flights and vessels, and Stellwagen Bank National Marine Sanctuary vessel)
- The effects of vessel traffic on the behavior of marine mammals (pilot completed).
- Determining larval sources and sinks based on the Gulf of Maine Circulation Model (pilot completed)

Research Needs:

- Extend multibeam surveys to adjacent areas identified as potential areas of expansion in the management plan (i.e., Jeffries Ledge, east to include Wildcat Knoll, and Great South Channel of Georges Bank).
- Continue process studies on role of habitat structure and function for fishes, as well as collect rate data on effects of fishing on habitat structure to develop predictive models.
- Use acoustic and optical methods to monitor dynamics of seafloor habitat change.
- Parameterize dynamic models of marine protected areas based on understanding of stage-based movement rates of fishes and dynamics of habitat change.
- Understanding vessel characteristics which result in differential behavioral responses of marine mammals.
- Developing geographic boundaries for larval sources and sinks based on larval period.



For Additional Information...

WEB SITES

National Marine Sanctuaries Web site:

<http://www.sanctuaries.nos.noaa.gov>

Science Page of the National Marine Sanctuaries Web site:

<http://www.sanctuaries.nos.noaa.gov/scied/science/science.html>

Sustainable Seas Expeditions Web site:

<http://sustainableseas.noaa.gov>

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